Physiotherapy

Unit 5. Physiotherapy

1. Introduction

Physiotherapy in a Panchakarma setting aims to **restore movement, reduce pain, and enhance functional independence** by using therapeutic exercise, thermal agents, electrotherapy, and manual techniques. It integrates smoothly with **Snehana** (oleation) and **Swedana** (fomentation): unctuous heat softens tissues, **opens srotas**, and reduces **Vāta–Kapha** stiffness, thereby improving the **stretch tolerance, joint glide, and neuromuscular activation** achieved by physiotherapy.

Core principles you will use repeatedly:

- **Specificity & SAID** (Specific Adaptation to Imposed Demands): train the pattern you want to improve.
- **Overload & Progressive loading:** adequate intensity and volume are required to gain strength or endurance.
- **Reversibility:** benefits regress if training stops; prescribe **home programs**.
- **Tissue healing timelines:** protect acutely injured tissues; load gradually in sub-acute and chronic phases.
- **Screening & safety:** check red flags (fever, unexplained weight loss, severe night pain, progressive neurological deficits), contraindications to heat/electrotherapy, and skin integrity before any modality.

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2. Static Exercise (Isometric)

Definition: Force is generated **without** an appreciable change in muscle length or joint angle (e.g., pressing against an immovable object).

Physiology & clinical value

- **Motor unit recruitment** improves around the trained joint angle (carryover ~10–20° either side).
- **Analgesic effect** via descending inhibition when dosed sub-maximally.
- Useful when **joint motion is painful/unsafe** (acute phase, immobilisation), to **prevent atrophy** and maintain tendon–bone interface load.

Indications

- Post-injury or post-operative protection phases, osteoarthritis pain near end-range, patellofemoral pain (mid-range quads sets), cervical pain (deep neck flexor holds), rotator cuff pain (neutral-position setting), and as a **pre-activation** before isotonic work.

Contraindications & precautions

- Uncontrolled hypertension/cardiac disease (avoid **Valsalva**), painful inflammatory synovitis in the targeted angle, hernia risk. In elderly or deconditioned, cue **breathing** and avoid straining.

Dosage guide (strength/endurance)

- **Intensity:** 40–60% MVIC (maximal voluntary isometric contraction) for strength; 20–40% for endurance/pain relief.
- **Hold time:** 6–10 seconds; **repetitions:** 6–10 per set; **sets:** 1–3; **frequency:** daily in early rehab.
- **Angles:** 3–5 angles across range if joint ROM allows; emphasize the **pain-free** mid-range first.

Clinical examples to memorise

- **Quadriceps set:** supine, knee in slight flexion, tighten thigh to push knee down; 10×10-sec holds.
- **Glute set:** supine, squeeze buttocks 10×10-sec.
- **Cervical chin-tuck (deep neck flexor):** 10×10-sec with gentle breathing.

- **Rotator cuff setting** in neutral with towel roll, internal/external rotator sub-max holds.

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3. Isotonic Exercise

Definition: Muscle changes length under load—**concentric** (shortening) and **eccentric** (lengthening). Resistance may be **constant** (free weights) or **variable** (machines, elastic bands).

Open-chain vs Closed-chain

- **Open-chain** (distal segment free): better for isolated strengthening (e.g., knee extension machine).
- **Closed-chain** (distal fixed): functional, joint-compressive, co-contraction (e.g., squats, step-ups).

Dosing by goal

- **Strength:** 60–80% of 1RM, **8–12 reps**, 2–4 sets, **2–3 days/week** with 48 h between sessions.
- **Endurance:** 40–60% of 1RM, **15–25 reps**, 2–4 sets, short rests.
- **Power (later rehab):** moderate load, faster concentric, controlled eccentric.
- **Progression:** the **2-for-2 rule**—if you can perform 2 extra reps over target in last set for 2 sessions, increase load by 2–10%.
- **Tempo: 2–0–2** (concentric–pause–eccentric) initially; emphasize **slow, controlled eccentrics** for tendinopathies.

Safety

- Warm-up; respect pain ≤3/10 and **no increase next day** for reactive tendons. Avoid deep flexion angles in irritable patellofemoral syndrome; cue neutral spine; integrate **breathing**.

Examples (knee OA protocol)

- **Closed-chain:** sit-to-stand, mini-squats, step-ups, wall slides.
- **Open-chain:** terminal knee extensions with band, hamstring curls.
- **Hip abductors/gluteals:** side-lying abduction, bridges, monster walks.

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4. Deep Heating Modalities

These heat tissues **>1.5–5 cm** depth to reduce pain and stiffness, increase extensibility, and prepare for mobilisation or exercise.

(a) Shortwave Diathermy (SWD)

- **Frequency:** 27.12 MHz (most common).
- **Modes:** Capacitive (superficial tissues) or Inductive (muscle).
- **Dose:** 15–30 min; **thermal dosing** often described as I–IV (from no warmth to vigorous but comfortable warmth).
- **Indications:** chronic myofascial pain, muscle spasm, osteoarthritis in large joints, capsular stiffness.
- **Contraindications:** pacemakers/implanted devices, pregnancy (abdomen/pelvis), malignancy, active bleeding, infection, **metallic implants** (precaution—prefer inductive with spacing or avoid), sensory loss, acute inflammation.

(b) Microwave Diathermy (MWD)

- **Frequencies:** 915 or 2450 MHz.
- More **surface-weighted** than SWD; careful spacing and power to avoid hot spots.
- Similar indications/contraindications to SWD; less common in many centres.

(c) Therapeutic Ultrasound (US)

- **Frequencies: 1 MHz** (deep, up to ~5 cm) and **3 MHz** (superficial, ~1–2 cm).
- **Modes: Continuous** (thermal) vs **Pulsed** 20–50% (non-thermal/cavitation–microstreaming).
- **Intensity:** typically **0.8–1.5 W/cm²** (continuous) for chronic, lower for pulsed/acute; **time** ~5–10 min per effective radiating area (ERA).
- **Indications:** tendinopathies (non-irritable phase), adhesive capsulitis (with stretching), myofascial trigger zones, scar remodelling; **phonophoresis** to enhance topical drug penetration.
- **Contraindications:** growth plates (caution), pregnancy over abdomen/pelvis, malignancy, thrombosis, infected tissue, eyes/heart/brain/spinal cord (laminectomy sites), cemented or plastic implants.

Clinical tip: Stretch or mobilise **immediately after heating** to capture the transient increase in tissue extensibility.

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5. Superficial Heating Modalities

(a) Moist Hot Pack (Hydrocollator pack)

- **Tank temperature: 70–75°C**; wrap in **6–8 towel layers**; **15–20 min**.
- **Indications:** sub-acute/chronic muscle spasm, pre-mobilisation warm-up.
- **Contraindications:** impaired sensation/circulation, acute inflammation, active bleeding, DVT, open wounds without protection.

(b) Paraffin Wax Bath (Hand/Foot)

- **Temp: 47–54°C**; **dip-wrap** method **6–10 dips**, then wrap for **15–20 min**.
- **Indications:** osteoarthritis/RA (non-oozing) of hands, scars/contractures before stretching.
- **Contraindications:** open wounds, sensory loss, PVD, infection.

(c) Infrared (IR) Lamp

- **Distance:** usually **45–60 cm**; **15–20 min**; eye protection; avoid metallic jewellery.
- **Indications:** superficial warming, small area soreness.

(d) Warm Whirlpool / Hydrotherapy

- **Temp: 36–40°C** (limb tanks); used for wounds (under sterile protocols), stiffness, or to combine with **active movement**.
- **Contraindications:** maceration-prone skin, infection without additives/controls, cardiac instability (for whole-body immersion).

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6. Electro Therapy

(a) TENS (Transcutaneous Electrical Nerve Stimulation)

- **Conventional (high-frequency): 50–100 Hz**, short pulse width (50–80 µs), sensory-level intensity—**for acute pain** via gate control.
- **Acupuncture-like (low-frequency): 2–10 Hz**, longer pulse width (150–250 µs), strong but tolerable motor twitch—**for chronic pain** via endogenous opioids.
- **Duration:** 20–40 min; can repeat daily.
- **Contraindications:** pacemaker/ICD, pregnancy uterus region, carotid sinus, open wounds (for standard electrodes), epilepsy (head/neck), impaired sensation/comprehension.

(b) Interferential Therapy (IFT)

- **Principle:** two medium-frequency currents (e.g., 4000 Hz) intersect to produce an **AMF** (1–150 Hz) deeper in tissues.
- **Application:** 10–20 min, four-pole or pre-modulated two-pole; useful for **larger/deeper** painful areas.

(c) NMES / FES (Neuromuscular & Functional Electrical Stimulation)

- **Goal:** strengthen weak muscles, prevent atrophy, facilitate function (e.g., **peroneal nerve FES** for foot drop, **supraspinatus NMES** for post-stroke subluxation).
- **Parameters (typical):** frequency **35–50 Hz**, pulse width **200–400 µs**, duty cycle **on:off = 1:3 to 1:5**, **ramp** 1–2 s; **10–15 contractions** per session, **3–5 sessions/week**.
- **Combine with volitional effort** for motor relearning.

(d) Galvanic/Denervated Muscle Stimulation

- **Pulsed DC** with long pulse durations **10–100 ms**; used selectively in **documented denervation** to slow atrophy—specialist application due to burn risk.

(e) Iontophoresis

- **Low-amplitude direct current** to deliver ionic medications transdermally (e.g., anti-inflammatories) to superficial tissues; monitor skin closely.

Global safety for electrical modalities: inspect skin, remove metal/jewellery in treatment field, maintain **clean electrodes**, and stop for dizziness, chest symptoms, or unusual pain. Document **parameters and patient response** each session.

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7. Manual Therapy

Definition: Skilled, hands-on techniques for **joint and soft-tissue** dysfunction aimed at pain relief, improved mobility, and neuromotor control. Complements **Snehana–Swedana**: warmed, lubricated tissues respond better to mobilisation and stretching.

(a) Joint Mobilisation

- **Maitland Grades I–IV:**
  - **I–II:** small/large amplitude **within pain-free range** for pain and guarding.
  - **III–IV:** large/small amplitude **into resistance** to increase ROM (performed when pain is low/absent and end-feel is stiff).
- **Kaltenborn traction: Grade I (loosen)** for pain, **II (tighten)** for taking up slack, **III (stretch)** to increase joint play.
- **Indications:** hypomobility, capsular stiffness (e.g., adhesive capsulitis), post-immobilisation.
- **Contraindications:** fracture, malignancy in area, active inflammatory arthropathy (acute RA), **gross instability**, advanced osteoporosis; cervical manipulation high-velocity thrusts are **not** performed without specialised training and vascular screening.

(b) Soft-Tissue Techniques

- **Myofascial Release, Deep Transverse Friction (Cyriax), Trigger-point pressure, Instrument-assisted techniques.** Useful for tendon adhesions, muscle tone reduction, scar remodelling.
- **Contraindications:** acute tears, active infection, DVT, unhealed sutures.

(c) Muscle Energy Techniques (MET)

- **Post-isometric relaxation**: patient performs a **gentle isometric contraction (5–10 s)** against therapist

resistance; upon relaxation, the muscle is **repositioned into the new barrier**; repeat 3–5 cycles. Good for hamstrings, hip flexors, upper trapezius.
- **Precautions:** avoid strong efforts in acute pain; maintain breathing.

(d) Proprioceptive Neuromuscular Facilitation (PNF) Stretching

- **Hold-relax / Contract-relax:** 5–10 s contraction into resistance, followed by 10–30 s stretch; **2–4 repetitions**. Effective for increasing ROM once pain is controlled.

Documentation essentials: pain (VAS/NRS), **ROM (goniometry)**, **MMT grade/hand-held dynamometer**, functional tests (sit-to-stand, timed up-and-go), and patient-reported outcomes.

Quick Parameter Tables

A. Heating Modalities

Modality	Typical dose	Key precautions
Moist hot pack	15–20 min; 6–8 towels	Check skin every 5 min; impaired sensation/circulation
Paraffin bath	47–54°C; 6–10 dips; 15–20 min	No open wounds/infection
SWD	15–30 min; thermal dose I–IV	Pacemaker, pregnancy, metal, malignancy
Ultrasound	1 MHz (deep), 3 MHz (superficial); 0.8–1.5 W/cm²; 5–10 min/ERA	Avoid eyes, brain, spine laminectomy, thrombosis, abdomen in pregnancy

B. Electrotherapy (pain & muscle)

Modality	Frequency / PW	Time	Notes
TENS—conventional	50–100 Hz; 50–80 µs	20–40 min	Sensory-level; acute pain
TENS—acupuncture-like	2–10 Hz; 150–250 µs	20–40 min	Strong but tolerable; chronic pain
IFT	AMF 1–150 Hz	10–20 min	Large, deeper fields
NMES	35–50 Hz; 200–400 µs; on:off 1:3–1:5	10–15 contractions	Add voluntary effort

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Integration with Panchakarma (Exam Hooks)

- **Before manual therapy or stretching**, apply **Snehana + Swedana** (e.g., abhyanga with tila taila followed by nāḍī-sweda). This mirrors modern practice of **heat before stretch** to improve tissue extensibility.
- **After electro-analgesia or heat**, schedule **isometric → isotonic** progressions to consolidate gains.
- **Vāta-pradhāna** pain syndromes: emphasise **snigdha heat + closed-chain loading + NMES** where needed.
- **Āma-dominant** presentations (e.g., early Āmavāta): avoid heavy snigdha heat and vigorous exercise; begin with **rūkṣa sweda**, gentle pain-relief TENS, and **low-load isometrics**, then progress when signs become **nirāma**.

Assessment

Long Answer Questions (Answer any 1, 10 marks)

1. Define **isometric** and **isotonic** exercise. Detail their **physiology, indications, contraindications, and dosing parameters**, and outline a **progression plan** for knee osteoarthritis from acute to chronic stages.
2. Describe **deep and superficial heating modalities** used in rehabilitation. Include **indications, contraindications, dosing**, and how you would **combine them with manual therapy and exercise** in a frozen shoulder case.
3. Explain **electrotherapy** (TENS, IFT, NMES/FES) with mechanisms, settings, and clinical decisions. Add **safety**

screening and documentation points.

Short Answer Questions (Any 5, 5×5 = 25 marks)

1. Write a **step-wise prescription** for isometric training of the quadriceps in patellofemoral pain.
2. Distinguish **open-chain** and **closed-chain** exercises with two examples and two indications each.
3. List **contraindications of SWD and Ultrasound** (any five).
4. State the **parameters of NMES** for shoulder subluxation after stroke and how you cue the patient during stimulation.
5. Give **four precautions** for moist hot packs and **four** for paraffin bath.
6. Explain **Maitland Grades I–IV** and their clinical aims.
7. Enumerate **TENS modes** and choose one for **acute lateral ankle sprain** with justification.
8. Outline a **home program** combining stretching and isotonic exercises for lumbar spondylosis (non-irritable phase).

MCQs (10 × 1 = 10 marks)

1. An isometric dosage for early strengthening commonly uses holds of:
   a) 1–2 s b) **6–10 s** c) 30–40 s d) 60–90 s
2. For improving strength in isotonic training, a standard starting range is:
   a) 20–30% 1RM b) 30–40% 1RM c) **60–80% 1RM** d) 90–100% 1RM
3. **1 MHz ultrasound** is preferred when the target tissue depth is approximately:
   a) 0.5–1 cm b) **3–5 cm** c) 6–8 cm d) only tendons
4. SWD is **contraindicated** in:
   a) Osteoarthritis knee b) **Pregnancy pelvis** c) Chronic back spasm d) Postural myalgia
5. Conventional TENS (high frequency) primarily acts via:
   a) Muscle strengthening b) Tissue heating c) **Gate control** d) Endorphin release only
6. NMES for strengthening typically uses frequencies around:
   a) 1–5 Hz b) 10–20 Hz c) **35–50 Hz** d) 100–150 Hz
7. Paraffin bath is ideal for:
   a) Acute ankle sprain b) **Hand OA stiffness** c) Open wounds d) Deep hip muscles
8. Maitland Grade III mobilisation aims to:
   a) Pain relief only b) **Increase range by moving into resistance** c) Traction only d) Muscle strengthening
9. A simple rule to increase load in isotonic training is the:
   a) 10-for-10 rule b) **2-for-2 rule** c) 1-for-3 rule d) DOMS rule
10. A precaution common to **all electrotherapy** is to avoid electrodes over:
    a) Triceps b) Quadriceps c) **Carotid sinus** d) Paraspinals

Answer key: 1-b, 2-c, 3-b, 4-b, 5-c, 6-c, 7-b, 8-b, 9-b, 10-c.

Quick Revision (60-second recap)

- **Static → Isotonic** progression: pain-free isometrics (40–60% MVIC, 6–10 s) → functional isotonic (60–80% 1RM, 8–12 reps).
- **Heat before stretch/mobilise:** superficial for warm-up; **deep** (US/SWD) when stiffness is capsular/deeper.
- **Electrotherapy:** TENS for pain (high-freq acute, low-freq chronic); NMES for weak muscles (35–50 Hz, on:off 1:3–1:5).
- **Manual therapy:** Grades I–II for pain; III–IV for ROM; always screen for red flags and instability.
- **Integrate with Panchakarma:** Snehana–Swedana → Manual/Exercise → Consolidate with home program and pathya.